Using the implicit relational assessment procedure (IRAP) to assess implicit gender bias and self-esteem in typically-developing children and children with ADHD and with dyslexia

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ABSTRACT

The current research comprised two studies that explored the utility of the Implicit Relational Assessment Procedure (IRAP) as a measure of children's implicit attitudes to the self. Study 1 ($N = 20$) involved a sample of children with ADHD and typically-developing children, all aged between 8 and 11 years. Across IRAP trials, each child's own name (e.g., MARY) was juxtaposed with a common name of the opposite gender (e.g., PETER), and presented in conjunction with three positive or three negative words and the two relational terms SIMILAR and OPPOSITE. The results indicated that both groups of children showed an implicit pro-self bias in trial-types denoted as Self-Positive and Self-Negative. While the typically-developing children were neither positive nor negative towards the other gender, the children with ADHD showed a pro-other bias in the Other-Negative trial-type. Study 2 ($N = 20$) involved typically-developing children and children with dyslexia, all aged between 9 and 14 years. Again, both groups showed a pro-self bias in the Self-Positive and Self-Negative trial-types, and both were neither positive nor negative in the Other-Positive trial-type. However, the typically-developing children were anti-others in the Other-Negative trial-type, while the children with dyslexia were pro-others. The study highlights the benefits of using both explicit and implicit measures, especially the IRAP, when assessing the implicit cognitions of children.

KEYWORDS: implicit relational assessment procedure, implicit attitudes, self-esteem, ADHD, dyslexia

» IMPLICIT MEASURES

Traditional methods of psychological assessment have relied heavily on direct self-report measures in which participants have the opportunity to carefully choose and deliberate their responses (hence the term *explicit attitudes*; see Greenwald & Banaji, 1995; Nosek, 2007). It is not surprising, therefore, that difficulties in accurate measurement, such as self-presentational biases, are commonly reported (e.g., de Jong, 2002; Teachman, Gregg, & Woody, 2001). Furthermore, cognitive researchers have recently argued that attitudes are guided, at least in part, by cognitive processes of which we are often not aware (Steele & Morawski, 2002), hence further limiting their potential use. In response to these difficulties, social psychologists have developed *indirect* measures that appear to capture what are called *implicit attitudes*. While these methodologies and the implicit attitudes they assess do not yield to introspection, they are nonetheless believed to impact upon behavior (Wiers, Teachman, & De Houwer, 2007). There are already a number of methodologies that measure the strength of implicit attitudes, including: the Implicit Association Test (IAT); the Go/No-go Association Task; the Extrinsic Affective Simon Task; and the Implicit Relational Assessment Procedure (IRAP). The Implicit Association Test (IAT) is by far the most commonly known and widely used implicit methodology with over 250 published studies of its use (Greenwald, McGhee, & Schwartz, 1998). The rationale of the IAT is that it should be easier to combine two concepts into a single response if they are associated in memory than if they are not. The IAT effect has repeatedly shown implicit attitudes and dysfunctional beliefs in a host of published studies across multiple domains (e.g., de Jong, 2002; de Jong, Pasman, Kindt, & van den Hout, 2001; Gemar, Segal, Segratti, & Kennedy, 2001; Teachman et al., 2001).

While the IAT emerged from mainstream social psychology and the associative learning tradition, it has captured the interest of behavioral researchers. However, unlike the former, the latter have argued that implicit attitudes are *relational* in nature, not merely associative. This perspective has been specifically advocated by researchers working in Relational Frame Theory (RFT), who have recently developed their own implicit measure, known as the Im-

plicit Relational Assessment Procedure (IRAP; Barnes-Holmes et al., 2006). In behavioral terms, the IRAP requires participants to respond quickly and accurately to stimuli deemed both consistent and inconsistent with their pre-experimentally established verbal relations. The IRAP effect is said to occur when the average latencies of responding to consistent beliefs are faster than to inconsistent beliefs. Indeed, what makes the IRAP more precise than any other indirect measure is its ability to focus on specific stimulus relations (e.g., coordination, hierarchy, spatial, temporal, and comparative) and even propositions concerning the self (e.g., deictic relations) with varying levels of relational complexity. As a result, the measure may well facilitate the study of more complex psychological phenomena than the IAT (see Hughes, Barnes-Holmes, & Vahey, 2012, for an extended account).

The IRAP is also distinct in format from the IAT in that it does not involve an increasingly complex set of tasks presented across blocks, instead all IRAP blocks are identical in form. This latter feature, in particular, suggests its potential utility with children. Consider a standard IRAP trial in which participants are required to match the sample word PLEASANT or UNPLEASANT with a positive or negative target word (e.g., HOLIDAY or CANCER) using the relational response options SIMILAR or OPPOSITE. Trial blocks are only differentiated in terms of whether the correct response is deemed to be consistent with established participant attitudes (e.g., PLEASANT-HOLIDAY-SIMILAR) or inconsistent (e.g., UNPLEASANT-CANCER-OPPOSITE). In short, it is assumed experimentally that most participants come into an experiment with an established verbal history in which the words HOLIDAY and PLEASANT are coordinated or similar in the sense that both are positively evaluated. In this case, the relationship between PLEASANT and HOLIDAY is deemed to be consistent when their combination is responded to by selecting SIMILAR. Alternatively, the relationship between PLEASANT and HOLIDAY is deemed to be inconsistent when their combination is responded to by selecting OPPOSITE. Similarly, for most participants the words CANCER and UNPLEASANT are coordinated or similar in the sense that both are negatively evaluated. In this case, the relationship between UNPLEASANT and CANCER is deemed to be consistent when their combination is responded to by selecting SIMILAR. Alternatively, the relationship between UNPLEASANT and CANCER is deemed to be inconsistent when their combination is responded to by selecting OPPOSITE. Researchers have reported strong and predicted IRAP effects across a growing array of clinical and social domains in adult samples, while also showing predictive validity in several clinically relevant behaviors (see Hughes et al., 2012).

While there are hundreds of published studies on the implicit attitudes of adults, similar research on children is very limited. Skowronski and Lawrence (2001) were among the first to use the Implicit Association Test (IAT) with children to study gender stereotyping in typically-developing 11 year olds. Although the data did not show the expected implicit bias towards the children's own gender nor against the opposite gender, the researchers reported no procedural difficulties in using the IAT with such a young sample. In contrast, considerable difficulties were subsequently reported by Rutland, Cameron, Milne and McGeorge

(2005) when presenting the IAT to 6 to 7 year olds. In response, the researchers developed a pictorially-based IAT, in which the attribute words were replaced with cartoon faces (e.g., PLEASANT and UNPLEASANT were replaced with happy and sad cartoons, respectively). In addition, the more conventional keyboard press responses were replaced with moving the computer mouse either towards or away from the screen. The authors found that from an early age children showed implicit intergroup bias and reported positive benefits of using the modified IAT.

The IAT was further modified, referred to as the *Ch-IAT,* by Baron and Banaji (2006) who replaced the attribute words with audio recordings in an attempt to control for reading level variability. The response options were changed again to simple button presses (e.g., one for GOOD, another for BAD). These procedural adjustments appear to have been more effective as the data showed that the sample of Caucasian American 6–10 year olds displayed the expected pro-white and anti-black biases. Similar and expected outcomes were also reported by Dunham, Baron, and Banaji (2006), who used the same modified procedure to show a pro-white bias with a sample of Caucasian American and Japanese 6 and 10 year olds.

» THE CURRENT RESEARCH

Due to the small body of IAT research with children and the absence of any published IRAP studies with children, the current work represents the first attempt to employ the IRAP with a young sample. The primary aim of the current research sought to explore the utility of the IRAP with groups of children who were not typically-developing, and who might therefore experience challenges navigating the procedure, not experienced by their typically-developing counterparts. Specifically, we included children with Attention Deficit Hyperactivity Disorder (ADHD) who may present with attentional challenges, as well as children with dyslexia, who may present with reading challenges. Overall, our aim with all three groups of children was primarily to explore the procedural utility of the IRAP with young people.

In order to demonstrate this, we conducted two studies which investigated the children's implicit attitudes to the self vs. the opposite gender. Gender was depicted through common names (e.g., PETER for boys and LOLA for girls) which were juxtaposed against the name of each participant. We chose to investigate gender bias specifically with the young samples because a wealth of developmental literature indicates that gender biases in terms of pro-self and anti-others are well established in elementary school children (Eagly & Mladinic, 1989; Ebert & Steffens, 2008). Indeed, Cvencek, Greenwald and Meltzoff (2011) found implicit gender biases in children as young as four years. Hence, we chose children at least of this age. Numerous IAT studies have also examined gender bias in adults (Rudman & Goodwin, 2004) and Vahey, Barnes-Holmes, Barnes-Holmes and Stewart (2009) found strong pro-self biases in adults using the IRAP. However, it is important to note that the current research was not designed to demonstrate potential differences between the groups of children, but rather to investigate the utility of the IRAP with young children and children with specific challenges. Should any unsuspected differences emerge between the groups of children, further research would be required to investigate this.

Table 1. Stimulus arrangements employed in study 1

Sample 1	Sample 2
(Participant's) OWN NAME	(Opposite gender name) PETER/LOLA
Response option 1	**Response option 2**
SIMILAR	OPPOSITE
Targets deemed consistent with sample 1	**Targets deemed consistent with sample 2**
ACCEPTED	FAULTY
POPULAR	BROKEN
PERFECT	USELESS

Study 1

The primary aim of Study 1 was to examine the utility of the IRAP in measuring implicit gender bias in children with and without ADHD. While the former group of children were selected based on the possibility that they may present with attentional challenges during the IRAP, they also offered us the opportunity to begin to address the on-going controversy over self-esteem in this population (e.g., Selikowitz, 2004). That is, while the majority of studies suggest that self-esteem in this population is lower than average (e.g., Barber, Grubbs, & Cottrell, 2005; Biederman, 2005; Edbom, Lichtenstein, Granlund, & Larsson, 2006; Ek, Westerlund, Holmberg, & Fernell, 2008; Treuting & Hinshaw 2001), several studies appear to show self-esteem within the normal to above-average range (e.g., Gresham, MacMillan, Bocian, Ward, & Forness, 1998; Hoza, Pelham, Milich, Pillow, & McBride, 1993; Hoza, Pelham, Dobbs, Owens, & Pillow, 2002; Hoza et al., 2004; Owens, Goldfine, Evangelista, Hoza, & Kaiser, 2007; Stewart & Buggy, 1994). Study 1 also examined potential correlations between the IRAP as an implicit measure and the Piers-Harris Children's Self-Concept Scale-2 (PH2) as an explicit measure.

» METHOD

Participants

Twenty children were recruited through direct contact with elementary and post-elementary schools in Ireland, and written parental and participant consent were obtained in all cases. The children ranged in age from 8 to 11 years (M = 9 years, 11 months). The 10 typically-developing children (6 females and 4 males) had all been categorised by independently educational assessment as within the "normal" range of intellectual functioning, with no prior history of behavioral or learning difficulties. The 10 children with ADHD (2 females and 8 males) all had an independent diagnosis of ADHD, but were categorized as within the "normal" range of intellectual functioning.

Setting

All aspects of the study were conducted in a quiet room in each participant's school, with the Researcher and a familiar Special Needs Assistant (SNA) present at all times. All participation was on an individual basis.

Apparatus and materials

The study simply involved the presentation of the Piers-Harris Children's Self-Concept Scale 2 (PH2) and an implicit measure (the IRAP).

PH2. The PH2 is a self-report instrument for the assessment of self-concept in children (Piers & Herzberg, 2003). The measure comprises a 60-item questionnaire with a scoring range of 0–69. It is sub-divided into six self-concept subscales: Behavioral Adjustment (14 items); Intellectual and School Status (16 items); Physical Appearance and Attributes (11 items); Freedom from Anxiety (14 items); Popularity (12 items); and Happiness and Satisfaction (10 items). Responding simply involves circling YES or NO in terms of whether each statement applies to the respondent. Answers are converted to an overall standardised T-score. A higher T-score indicates higher self-concept and a lower score indicates lower self-concept (i.e., 30–44 = LOW; 45–59 = AVERAGE; and 60–69 = HIGH).

The Implicit Relational Assessment Procedure (IRAP). The IRAP software may be downloaded from http://irapresearch.org/downloads-and-training/. The "self" was represented in the sample stimulus by each child's name and the category of "others" was represented by a person with a name from the opposite gender. For example, if the participant was a young boy called Martin, the samples were MARTIN (self) and LOLA (girl's name), but if the participant was a girl called Mary, the samples were MARY and PETER (boy's name) (capital letters denote actual stimuli). In all cases, LOLA and PETER were used as names of the opposite gender. The target stimuli contained six evaluative terms, three positive (ACCEPTED, POPULAR, and PERFECT) and three negative (FAULTY, BROKEN, and USELESS). The response options comprised the words SIMILAR and OPPOSITE and were represented by the letters 'd' and 'k' on the keyboard. The stimulus arrangements for the IRAP are presented in Table 1. A series of flash cards depicting screen shots of IRAP trials were employed to familiarize the children with the procedure (see below).

Procedure

All participants completed the study in a single session that lasted between 30 and 40 minutes. Although made available to them throughout the session, none of the children opted for a short break. All participants were presented with the same experimental sequence that involved exposure to the PH2 followed after a short break by the IRAP.

PH2. At the beginning of the study, participants were provided with extensive verbal instructions regarding completion of the PH2, but no influence was exerted on any responses. The Researcher remained seated beside each participant throughout all aspects of the questionnaire.

The IRAP. The first set of IRAP instructions to which participants were exposed was explicitly designed to ensure that they understood the meanings of all six target words (e.g., FAULTY). Thereafter, a series of flash cards guided the children on how the program works. For illustrative purposes, the instructions presented to a female participant called Mary were as follows:

Sometimes the computer will want you to match your OWN NAME (MARY) with this set of words (participant was shown

*the three positive target stimuli),
and sometimes it will want you
to match the word* PETER *to this
set of words (participant is shown
the three negative target stimuli).
So, you might have to match your*
OWN NAME *with* ACCEPTED *and*
PETER *with* FAULTY.

*Then the computer will change
its mind and it will want you to
match your* OWN NAME *with
this set of words (the three nega-
tive target stimuli) and the word
PETER with this set of words (the
three positive target stimuli). So,
now you might have to match
your* OWN NAME *with* FAULTY
and PETER *with* ACCEPTED.

*In order to match the words in this
game you have to press either the
'd' or 'k' button on the keyboard.
Can you show me where they are?
They are the only two keys you
have to press. You do not have to
press anything else. Ok?*

Now, there are two other words involved in this game - OPPO-
SITE *and* SIMILAR. *So if I tell you that I want you to match
your* OWN NAME *to* ACCEPTED, POPULAR, *and* PERFECT *and
you see this coming up on the screen (child is presented with
schematic representation of a consistent trial with* OWN NAME*)
which key will you press? Will you press 'd' or 'k'?*

Ok, so what happens if PETER *and* ACCEPTED *come up on
the screen, but I have told you that I want you to match your*
OWN NAME *to* ACCEPTED*? What key would you press? Would
you press 'd' or 'k'?*

*Now, like all games, there is a little trick involved between
the words* OPPOSITE *and* SIMILAR. *Sometimes the word
OPPOSITE is on this side of the screen (child is shown sche-
matic representation of* OPPOSITE *on the left-hand side of
the screen) and sometimes it is over on the other side of
the screen (representation of* OPPOSITE *on the right hand
side). It's also the same for the word* SIMILAR. *Sometimes
it is on this side of the screen (left) and then it changes to
the other side of the screen (right). So the trick is that you
have to keep your eye on which side of the screen* OPPOSITE
and SIMILAR *are on, because remember, you have to press
'd' or 'k' to match the words. So your job in this game is to
keep your eye on the word at the top (i.e.,* OWN NAME *or
PETER), the word in the middle (e.g.,* ACCEPTED*) and the
places in which* OPPOSITE *and* SIMILAR *appear on the
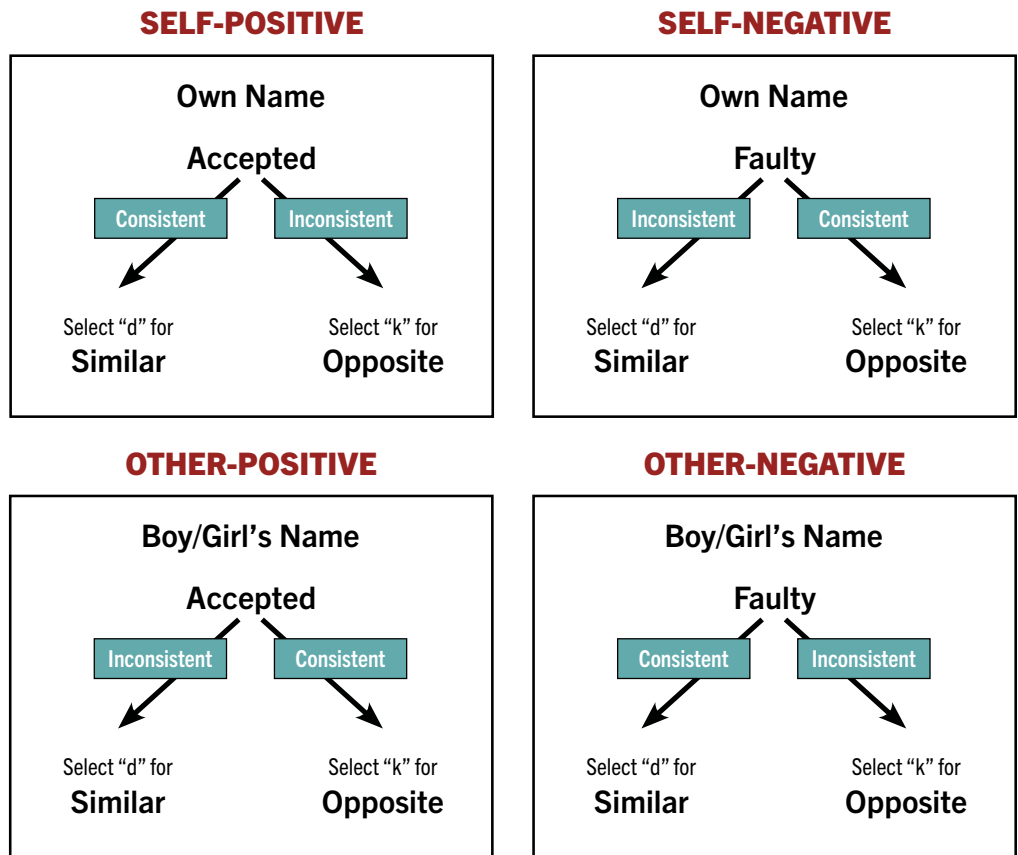screen. Do you understand?*

Figure 1. Schematic representation of the four IRAP trial-types (neither arrows nor consistent/inconsistent boxes were visible).

Flash cards also contained schematic representations of each of the four trial-types. This yielded a total of four pictures: Self-Positive (top left of Figure 1); Self-Negative (top right); Other-Positive (bottom left); and Other-Negative (bottom right). Participants received several practice trials with these visual illustrations before exposure to the automated procedure.

Participants were required to practice responding in ways deemed both consistent and inconsistent with their beliefs. Consistent responding required showing positivity towards the self (i.e., Self-Positive-SIMILAR and Self-Negative-OPPOSITE) and negativity towards others (Other-Positive-OPPOSITE and Other-Negative-SIMILAR). Inconsistent responding required participants to show negativity towards the self (Self-Positive-OP-POSITE and Self-Negative-SIMILAR) and positivity towards others (Other-Positive-SIMILAR and Other-Negative-OPPOSITE).

Each block of IRAP trials contained six exposures to each of the four trial-types randomly presented across the block (i.e., a total of 24 trials in each block). On each of the six exposures, each of the three target stimuli appeared twice with the same sample. For example, each participant was presented with six Self-Positive trials (i.e., two ACCEPTED, two POPULAR, and two PERFECT).

The IRAP sequence

The IRAP sequence was always presented as alternating blocks of consistent and inconsistent trials, hence requiring participants to switch responding across blocks. In order to control for potential

order effects, the sequencing of the blocks was counterbalanced across participants. That is, half of the children were presented with a consistent practice block first which required participants to respond in a pro-self/anti-other pattern (hereafter labeled as pro-self), followed by the inconsistent practice block which required them to respond in an anti-self/pro-other pattern (labeled as pro-other), followed by a consistent test block, and so on. In contrast, the other half were presented with an inconsistent practice block first, and so on.

Each complete IRAP comprised a total of eight blocks of trials, two practice blocks followed by six test blocks, always presented in that order. The first, third and fifth test blocks then required pro-self responding, while the second, fourth and sixth test blocks required pro-other responding. If the first practice block required participants to respond in a pro-other pattern, the alternative sequence ensued.

Practice blocks. At the beginning of each practice block and each of the first two test blocks, the children were given specific instructions on whether each block was a practice or test, and whether correct responding was consistent or inconsistent. The instructions provided regarding practice trials were specifically designed to teach the child (1) how to press the appropriate keys and (2) how to match the sample and target stimuli appropriately. The instructions provided to a male child (Sean) exposed to consistent trials first were as follows:

> *In order for you to learn how to play the game, we are going to do some practice. For this first practice I want you to match* OWN NAME (SEAN) *to* ACCEPTED, PERFECT *and* POPULAR, *and* GIRL'S NAME *to* FAULTY, BROKEN, *and* USELESS. *I will help you through the first few matching tasks. Ok?*

> *Can you sit in close to the computer and make sure you are comfortable? Good, now show me where you are going to put your fingers. Remember, for this game you only need to press the 'd' and 'k' keys on the keypad. When you are ready, just press the space bar (Researcher indicated location of spacebar) and the game will start.*

The first exposure to the first practice block was then presented. During the first few practice trials, the Researcher promoted each child by indicating the correct response option and the correct key associated with it. Prompting for correct responding continued until each child was familiar with correct responding (rarely exceeding 5 trials). If a child emitted an incorrect response during the initial practice trials, she/he was instructed as follows:

> *That's ok. Remember that I told you it is ok to get some wrong. All you have to do now is to press the correct key in order to go forward with the game. So, which key will you press?*

Throughout the first practice block, the Researcher also intermittently provided verbal feedback on correct and incorrect responding.

At the end of each block of trials, the IRAP presented participants with automated feedback on the percentage of trials correct and the median response time (in ms.) achieved during that block. The Researcher provided the children with further clarification on the meaning of the scores. For example, if a child's median reaction time on the first practice block exceeded 3000ms., he/she were instructed as follows:

> *Ok. That was very good. You seem to be getting the hang of this game. There is one other thing I need to tell you. In order to get to the next level of the game you need to try and keep your score under 3000ms. Ok? And I still want you to try to get as many right as you can. Ok?*

Hence, irrespective of performance, all children proceeded immediately with the second practice block.

The children were also instructed explicitly on how to switch responding across blocks. Consider the following instructions regarding the switch from a consistent to an inconsistent block for a female participant:

> *Ok, now do you remember that I told you that the computer sometimes changes its mind? This time it wants you to match* OWN NAME *to* FAULTY, BROKEN *and* USELESS *and a* GIRL'S NAME *to* ACCEPTED, PERFECT, *and* POPULAR. *This is still only a practice just like the last time. But I want you to try and go as fast as you can, while still trying to get as many right as you can. Ok?*

These instructions and presentations were repeated for the second block of practice trials.

Test blocks. All of the children were invited to take a short break between the second practice block and the first test block. The first test block then commenced with the following instructions:

> *Ok, it's obvious that you have caught onto this game really quickly. So I think you are ready to go on to the next stage. We are going to do this six more times, but as you can see you get through the stages really quickly and we will count each task together when you have finished. Ok?*

> *Now, this time I am not going to tell you which key to press. Ok? So, that means that the practice is now over and the computer is going to test you to see how much you remember. Ok? Before each matching task, I will just check with you to see if you remember which words you are matching to* PETER *and which words you are matching to your* OWN NAME. *Is that ok?*

> *Now, for the next ones can you tell me which words you have to match* PETER *to? (Researcher used the word lists to prompt the child and waited for a response). Now can you tell me which words you have to match your* OWN NAME *to? (Again, Researcher waited for the child's response).*

> *So, are you comfortable and ready to go? Make sure you have your fingers on the right keys. Remember -- try and go as fast as you can but still trying to get them right. Ok, off you go and press the space bar to begin.*

The Researcher continued to provide positive verbal encouragement regarding appropriate on-task behavior (e.g., "you are doing well and working really fast"), but not for accurate or incorrect responding. At the end of the sixth and final test block, the Researcher indicated to the children that the game was over and thanked them for their participation. Each child was then given a packet of gel pens for taking part in the study.

Feedback. Practice block feedback is outlined above. Test block feedback was incorporated into the IRAP program such that incorrect trials (but not correct trials) were consequated with written automatic feedback that indicated that an incorrect response had been emitted. This feedback involved the presentation of a red x that appeared automatically in the middle of the screen and remained there until a correct response was emitted. A visual representation of the feedback was presented along with the following instructions from the Researcher:

Ok. Like all games, you will sometimes match the words wrong and that's ok. The game is not about getting it right all of the time. Although it's important to get as many words right as you can, the trick is that you have to match the words as fast as you can while trying to get them right. Ok?

If you get one wrong, the computer will show you this (child is presented with the schematic representation of feedback) and the only way you can go forward in the game is to press the correct key. So the computer will actually tell you when you have made a mistake, ok?

A feedback reinforcer incorporating each participant's name saying, for example, "WELL DONE MARY" and cartoon pictures (e.g., a frog hopping out of the water) was incorporated into the program for correct responding and to encourage the children with ADHD to remain on task.

Performance criteria. The IRAP software recorded levels of accuracy and response latency for each participant on every trial. *Accuracy* was defined as the first response emitted on each trial. Hence, even if a subsequent accurate response was emitted on the same trial (because every trial incorporated a correction procedure for incorrect responding), the trial was recorded as incorrect. *Response latency* was defined as the time (in ms.) between the onset of the trial and the emission of a correct response. For inclusion in the current study, an accuracy rate of 70% and an average response latency of <3000ms was required in each block of trials.
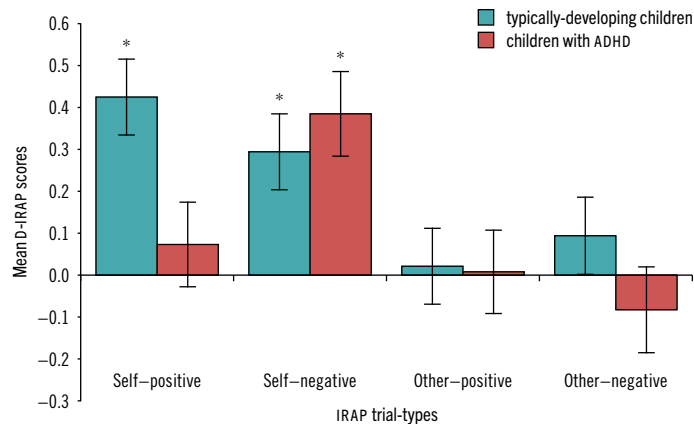

Figure 2. Mean D-IRAP Scores (including standard error bars) per group for each trial-type (asterisk denotes statistical significance from zero)

» RESULTS

Implicit measure

The primary datum on the IRAP was response latency, defined as the time (in ms.) from trial onset to emission of the first correct response and this was below 3000ms. for each participant. The latency data were transformed using the D-algorithm (Barnes-Holmes et al., 2006). The steps involved in calculating the D-IRAP scores using this algorithm are presented below. In line with previous IRAP research, accuracy data are used as a screening procedure to remove participants whose accuracy levels in any blocks are lower than 70%. Each of the children included in these analyses exceeded this criterion.

The D-algorithm. The version of the D-algorithm employed in the current study transforms the raw latency data for each participant using the following steps: (1) only use response latency data from test blocks; (2) eliminate latencies above 10,000ms. From the dataset: (3) eliminate the data from a participant for whom more than 10% of test block trials have latencies less than 300ms.; (4) compute 12 standard deviations for the four trial-types - four for the response-latencies from Blocks 1 and 2, four from the latencies from Blocks 3 and 4, and a further four from Blocks 5 and 6; (5) compute the 24 mean latencies for the four trial-types in each test block; (6) compute difference scores for each of the four trial-types for each pair of test blocks by subtracting the mean latency of the consistent block from the mean latency of the corresponding inconsistent block; (7) divide each difference score by its corresponding standard deviation from step 4, yielding 12 D-IRAP scores - one score for each trial-type for each pair of test blocks; (8) calculate four overall trial-type D-IRAP scores by averaging the three scores for each trial-type across the three pairs of test blocks.

Preliminary analyses (within-group comparisons). Figure 2 presents the mean D-IRAP scores per trial-type and group. Both groups of participants indicated responding in a manner that showed pro-self biases in line with experimental predictions. It is important to emphasize that response latencies from anti-other blocks were subtracted from pro-other blocks, and thus positive scores indicate anti-other/pro-self biases, whereas negative scores indicate pro-other/anti-self biases. That is, the children overall more readily related positive stimuli with their own name (i.e., Self-Positive-SIMILAR over OPPOSITE) *and* more readily defended their own name against negative stimuli (i.e., Self-Negative-OPPOSITE over SIMILAR). However, the mean D-IRAP scores indicated that the pro-self bias in the Self-Positive trial-type was stronger for the typically-developing children, relative to those with ADHD. Conversely however, the pro-self bias in the Self-Negative trial-type was stronger for the children with ADHD, than those without.
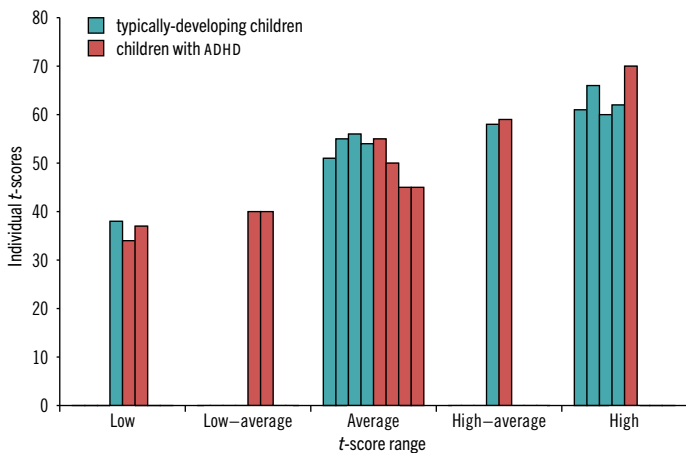
Figure 3. Individual PH2 *t*-scores by group and by category

The mean D-IRAP data also indicated very weak effects for both groups of children overall in relating positive stimuli with the other name (i.e., Other-Positive-SIMILAR and OPPOSITE). However, a pro-other bias in the Other-Negative trial-type was recorded for the children with ADHD (i.e., Other-Negative-OPPOSITE over SIMILAR), while an anti-other bias was recorded for the children without (i.e., Other-Negative-SIMILAR over OPPOSITE).

Mean score trial-type analyses. The D-IRAP means were entered into a 4x2 mixed repeated measures Analysis of Variance (ANOVA), with group as the between participant variable and trial-type as the within participant variable. There was a significant main effect for trial-type [$F(3, 18)$, = 4.67, $p = 0.0057$, $\eta_p^2 = 0.206$], with post-hoc analyses indicating that the difference lay on Self-Positive vs. Other-Negative and Self-Negative vs. Other-Positive trial-types. The main effect for group was non-significant ($p = 0.18$) and there was no significant interaction ($p = 0.21$).

Two separate one way ANOVAs (one per group) revealed a significant main effect for trial-type for the children with ADHD [$F(3, 9) = 3.361$, $p = 0.0333$, $\eta_p^2 = 0.272$] and an effect that approached significance for those without [$F(3, 9)$, = 2.585, $p = 0.0557$, $\eta_p^2 = 0.241$]. Post-hoc analyses of trial-types indicated significant differences on Self-Negative vs. Other-Positive and vs. Other-Negative (p's < 0.03) for the children with ADHD. There was also a significant difference on Self-Positive vs. Other-Positive ($p < 0.04$) for those without.

Eight one sample *t*-tests were conducted to determine whether each of the trial-type D-IRAP scores differed significantly from zero. Self-Positive was significant for the typically-developing children ($p < 0.01$), but not for the children with ADHD. Self-Negative was significant for both groups (p's < 0.02).

Four independent samples *t*-tests were conducted to analyze differences between the groups on each trial-type, and only responding on the Self-Positive trial-type was significantly different between children with ADHD and children without ($p < 0.04$).

Explicit measure

The *t*-scores for individuals in each group are presented in Figure 3. Of the 10 typically-developing children, one scored within the low range; four scored as average; one as high-average; and four as high. The group produced an overall mean *t*-score of 56 (i.e., high-average). The pattern of explicit self-esteem differed somewhat with the 10 children with ADHD. That is, two scored as low; two as low-average; four as average; one as high-average; and one as high, The group produced an overall mean *t*-score of 56 (i.e., average range).

The subscales of the PH2 were also analyzed (see Figure 4). The children with ADHD produced lower scores on all six subscales than the typically-developing children. However, it was only on Behavioral Adjustment and Popularity that the children with ADHD scored below average (i.e., low).

Correlations between the implicit and explicit measures

Correlations were calculated using Pearson's correlation coefficient for self-esteem scores for both groups of children on the PH2 *t*-score and the four D-IRAP scores. For the children with ADHD, the *t*-score correlated significantly with the Self-Positive trial-type ($r = .787$, $p = 0.007$) and with Other-Negative ($r = -0.806$, $p = 0.005$). However, there were no significant correlations for the typically-developing children (p's > 0.362).

Pearson's correlation coefficient was also used to assess correlations among the D-IRAP scores and the PH2 subscales. For the children with ADHD, Self-Negative significantly correlated with Behavioral Adjustment ($r = 0.703$, $p = 0.023$); Other-Positive correlated significantly with Popularity ($r = -0.758$, $p = 0.011$); and Other-Negative correlated significantly with Behavioral Adjustment ($r = 0.640$, $p = 0.046$). Again, for the typically-developing children, there were no significant correlations (p's > 0.05).
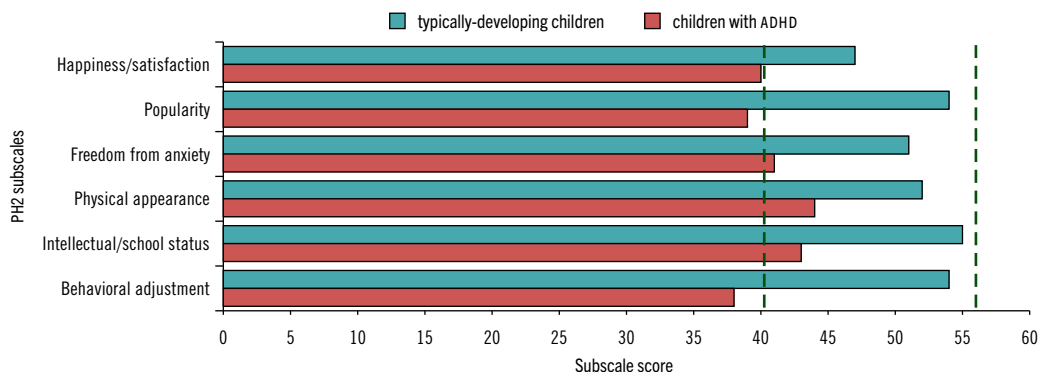

Figure 4. PH2 subscale scores for all participants by group (lines denote where average scoring should fall)

Summary of results

The results on the IRAP indicated that the typically-developing children had a stronger pro-self bias to their own name than the children with ADHD. Furthermore, the typically-developing children demonstrated an anti-other bias, while the children with ADHD demonstrated a pro-other bias. Differences were also observed on the PH2. Specifically, while both groups presented within the normal range of self-esteem, the typically-developing children had a higher average *t*-score than the children with ADHD. Furthermore, the children with ADHD scored within the low-to-low-average range across all of the subscales, while the typically-developing children scored as average.

Study 2

Study 2 was identical to Study 1, except that the sample of children with ADHD was replaced by a sample of children with dyslexia. The latter group of children were selected based on the possibility that they may present with reading challenges during the IRAP.

» METHOD

Participants

Twenty additional children were recruited for participation in Study 2. They ranged in age from 9 to 14 years (M = 10 years, 2 months). The 10 children with dyslexia (6 males and 4 females) all had an independent diagnosis of dyslexia, but were categorized as within the 'normal' range of intellectual functioning.

Setting

All aspects of the setting employed in Study 2 were identical to Study 1.

Apparatus, materials, and procedure

All aspects of the apparatus, materials, and procedure in Study 2 were identical to Study 1.

» RESULTS

Implicit measure

The latency data were again transformed into D-IRAP scores as in the previous study. Each of the children included in these analyses exceeded a criterion level of 70% accuracy and all response latencies were below 3000 ms.

Preliminary analyses (within-group comparisons). Figure 5 presents the mean D-IRAP scores per trial-type and group. Both groups of participants indicated responding in a manner that showed pro-self biases in line with experimental predictions. Similar to the results in Study 1, the children overall more readily related positive stimuli with their own name (i.e., Self-Positive-SIMILAR over OPPOSITE) *and* more readily defended their own name against negative stimuli (i.e., Self-Negative-OPPOSITE over SIMILAR). However, the mean D-IRAP scores indicated that the pro-self bias in the Self-Positive trial-type was slightly stronger for the children with dyslexia, relative to those without. The pro-self bias in the Self-Negative trial-type was the same for both groups.
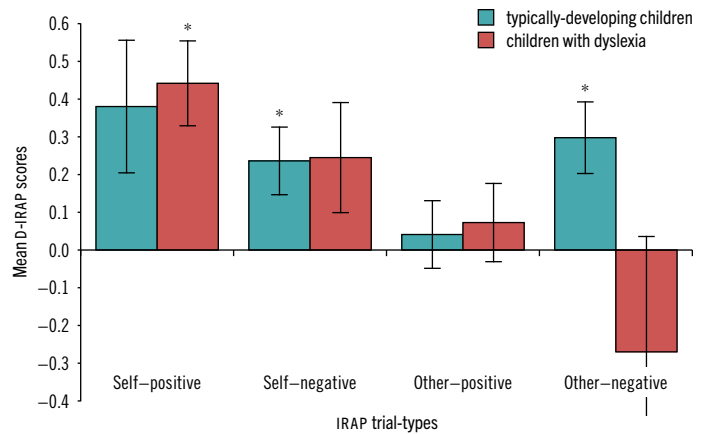

Figure 5. Mean D-IRAP Scores (including standard error bars) per group for each trial-type (asterisk denotes statistical significance from zero)

The mean D-IRAP data also indicated very weak effects for both groups overall in relating positive stimuli with the other name (i.e., Other-Positive-SIMILAR and OPPOSITE). However, a pro-other bias in the Other-Negative trial-type was recorded for the children with dyslexia (i.e., Other-Negative-OPPOSITE over SIMILAR), while an anti-other bias was recorded for the children without (i.e., Other-Negative-SIMILAR over OPPOSITE).

Mean score trial-type analyses. The D-IRAP means were entered into a 4 × 2 mixed repeated measures ANOVA. There was a significant main effect for trial-type [$F(3, 18)$, = 2.991, p = 0.0388, η_p^2 = 0.143], with post-hoc analyses indicating that the difference lay on Self-Positive vs. Other-Positive trial-types ($p < 0.01$). The main effect for group was non-significant (p = 0.36) and there was no significant interaction (p = 0.12).

Two separate one-way ANOVAS (one per group) revealed a main effect for trial-type for the children with dyslexia which approached significance [$F(3, 9)$, = 2.874, p = 0.054, η_p^2 = 0.242], but this was not significant for the typically-developing children (p = 0.21). Post-hoc analyses of trial-types indicated significant differences on Self-Positive vs. Other-Positive trial-type ($p < 0.01$) for the children with dyslexia. There were no significant differences between trial-types for the typically-developing children (p's > 0.05).
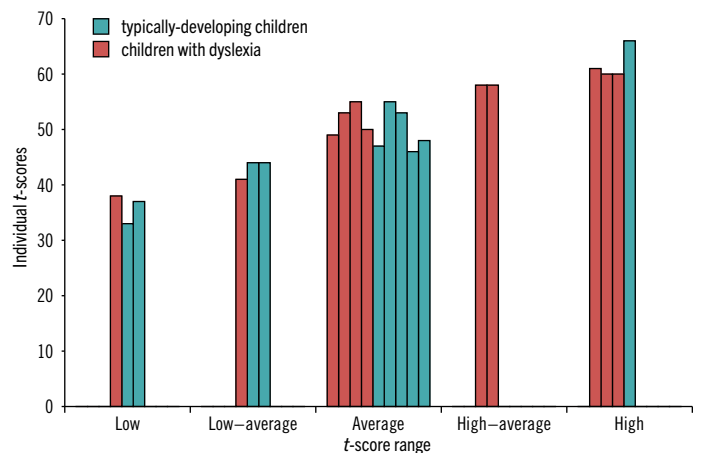

Figure 6. Individual PH2 *t*-scores by group and by category

Eight one sample *t*-tests were conducted to determine whether each of the trial-type mean D-IRAP scores differed significantly from zero. Self-Positive was significant for the children with dyslexia ($p < 0.004$), and approached significance for typically-developing children ($p = 0.059$). Self-Negative ($p = 0.03$) and Other-Negative ($p = 0.01$) were both significant for the typically-developing children. Four independent samples t-tests were conducted and found no differences between the groups on each trial-type (p's > 0.05).

Explicit measure

The *t*-scores for individuals in each group are presented in Figure 6. Of the 10 typically-developing participants, one child scored within the low-average range; four scored as average; two as high-average, and three as high. Of the 10 children with dyslexia, two scored as low; one as low-average; five as average; and one as high. The similarities across the two groups were also reflected in the group means, with the self-esteem mean for the children with dyslexia at 47.30 and 55 for those without (both average).

The subscales of the PH2 were also analyzed (see Figure 7). The children with dyslexia produced lower scores on all six subscales than the typically-developing children. However, it was only on Intellectual/School Status and Physical Appearance that the children with dyslexia scored below average (i.e., low-average).

Correlations between the implicit and explicit measures

Correlations were calculated using Pearson's correlation coefficient for self-esteem scores for both groups of children on the PH2 *t*-score and the four D-IRAP scores. The *t*-score did not correlate with any trial-type in either group of children (p's > 0.11).

Pearson's correlation coefficient was also used to assess correlations among the D-IRAP scores and the PH2 subscales. For the typically-developing children, Self-Positive correlated significantly with Freedom from Anxiety ($r = 0.641$, $p = 0.046$). For the children with dyslexia, Self-Positive correlated significantly with Intellectual/School Status ($r = -0.672$, $p = 0.033$) and Other-Negative correlated significantly with Happiness/Satisfaction ($r = -0.771$, $p = 0.009$).

» OVERALL SUMMARY OF RESULTS

Some pro-self differences emerged across the three groups of children involved in the study. That is, Study 1 indicated that typically-developing children had a stronger pro-self bias when relating positive stimuli to the self, than the children with ADHD

(i.e., D-IRAP score was almost five times greater). However, the two groups were equally reticent when relating negative stimuli to the self. Conversely, in Study 2, the two groups of children showed equally positive pro-self biases as indicated by the independent *t*-tests.

Some pro-other differences were also detected across the groups. In Study 1, the children with ADHD demonstrated a pro-other bias when relating negative stimuli to others, while the typically-developing children demonstrated a predicted anti-other bias. This suggests that the children with ADHD denied the relation between negative stimuli and others. Similarly, in Study 2, the children with dyslexia showed a pro-other bias which was also absent in typically-developing children.

Notably in Study 1, the pro-self bias in the children with ADHD was consistent with the explicit scores as it correlated with the *t*-score and the Behavioral Adjustment subscale. The pro-other bias in the children with ADHD was also consistent with the *t*-scoreand the Popularity and Behavioral Adjustment subscales. In Study 2, the pro-self bias was consistent with the PH2 Intellectual/School Status subscale in the children with dyslexia and Freedom from Anxiety in those without. The pro-other bias correlated with the PH2 Happiness/Satisfaction subscale in the children with dyslexia. The PH2 depicted in both studies that while all four samples fell within the normal range of self-esteem, the typically-developing children presented with higher overall self-esteem.

» DISCUSSION

The primary aim of the current research was to determine the utility of the IRAP in measuring implicit cognitions in typically-developing children and children presenting with ADHD or dyslexia. Indeed, one might expect that difficulties in attention and cognition pose a challenge to measures of implicit cognition because of the high accuracy and response latency criteria. However, this was not the case with any child who participated currently. All children proceeded rapidly, and with ease, through all aspects of the IRAP. Indeed, they all individually reported that they found the procedure both positive and challenging. This suggests, at least, the broad utility of the IRAP as a simple series of child-friendly computerized tasks. This procedural ease has not been readily reported with other implicit measures, such as the IAT, which has undergone numerous procedural modifications with mixed success, even with typically-developing children.

Nonetheless, it is important to emphasize that the current research employed a number of specific precautions to ensure that the children understood how to complete the tasks appropriately. These included: screen-shots of the target trial-types; extensive verbal and concrete instructions; and some verbal coaching during practice trials. It seems likely that the presence of these features greatly helped the children in terms of task motivation and com-
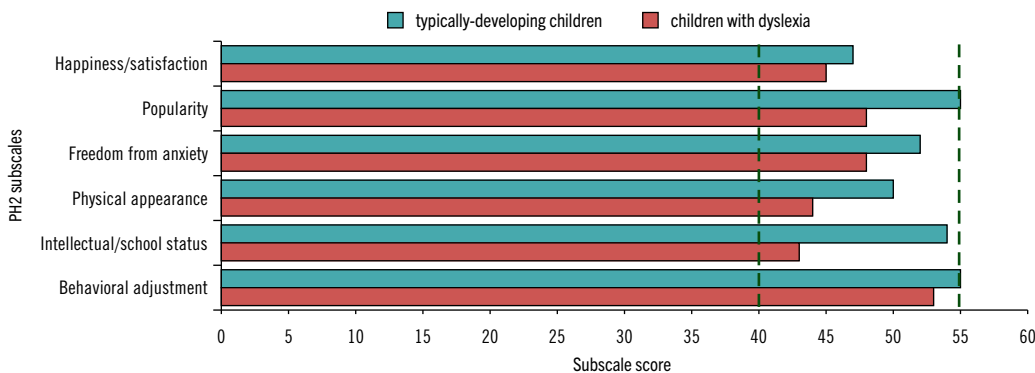
Figure 7. PH2 subscale scores for all participants by group (lines denote where average scoring should fall)

pletion. However, numerous studies have reported the use of similar features when administering the IRAP to adults from both typical and atypical samples (e.g., Vahey, Boles, & Barnes-Holmes., 2010).

The secondary aim of the current research was to preliminarily explore the use of the IRAP as a measure of implicit self-esteem in children. The current research generated sound and predicted IRAP effects for each group of participants. That is, the children in each group showed predicted positivity towards the self and negativity towards others (i.e., a pro-self and anti-other bias).

The outcomes recorded here for the two groups of typically-developing children were consistent with the existing literature on the development of self-esteem. These children in both studies showed strong implicit pro-self biases (Rathus, 2006). Specifically, they showed strong implicit and explicit positivity towards the self and depicted considerable implicit negativity towards others. This also supports RFT research on the development of perspective-taking, which appears to be well-established by age 5 (McHugh, Barnes-Holmes, & Barnes-Holmes, 2004). The findings that emerged for the children with ADHD and dyslexia on both measures were markedly different and highlighted some of the difficulties, including popularity and behavioral adjustment that this cohort of children experience (Bussing, Zima, & Perwien, 2000; Mrug, Hoza, Pelham, Gnagy, & Greiner, 2007).

In Study 1, there was a weak pro-self bias recorded for the group of children with ADHD which was consistent with the literature (Barber et al., 2005; Biederman, 2005; Edbom et al., 2006; Ek et al., 2008; Treuting & Hinshaw, 2001). The differences that emerged on the implicit and explicit measures for the children with ADHD add to the debate within the literature about the level of self-esteem that typically characterizes the group. The overall explicit scores support the view that children with ADHD present with normal self-esteem. However, the subscale data highlight specific areas of difficulties which may influence self-esteem levels over time (Rubin, 1998). Indeed, subscale information could prove valuable for the purposes of intervention, even when the overall self-esteem appears normal. This may be one aspect that accounts for the debate on whether or not one should expect normal or low self-esteem for the group.

The use of the IRAP offered a more comprehensive view of the ADHD profile of self-esteem regarding how this group viewed the self compared to others. The pro-other bias found concords with existing evidence that these individuals are more sensitive to the perceptions of others, including peers, family and teachers (Guevremont & Dumas, 1994; Wheeler & Carlson, 1994). Specifically, if individuals compare themselves to others and discriminate disparities, then they are more likely to favour others. This overestimation of others can be supported by two pieces of evidence. First, these individuals have been known to discriminate their own behavioral difficulties as problematic for themselves and *others*. This would likely render their perceptions of others as more positive (Hoza et al., 2005). Second, a range of significant psychological and/or emotional difficulties, including Oppositional Defiance Disorder often accompany the diagnosis (Barkley, 2003). Self-perceptions of these difficulties coupled with the access to support services offered by others would likely alter attitudes to others. Moreover, findings relating to popularity and behavioral adjustment further reflect the importance of others' attitudes towards these children. Overall, the findings suggesting that self-esteem is

within the average range was relatively consistent with the literature due to the tendency to focus on the positivity of others, rather than the negative (Stewart et al., 1994; Hoza et al., 1993).

The findings from Study 2 depicted how the children with dyslexia presented with equal levels of implicit self-esteem as those without. The data were also consistent with the findings on the explicit measures where all children scored within the average range of self-esteem. This was consistent with the explicit measure, despite the absence of notable correlations. This might imply that, although the individual diagnosis of dyslexia may impact upon their self-esteem, this has not been a negative influence on aspects of the related self. Furthermore, children diagnosed with dyslexia early in their lives, frequently have access to support services which commonly include emphasis on self-esteem building (Dyslexia Association of Ireland, 2007). It can be deduced that having such a learning difficulty may not necessarily pose sufficient intellectual, emotional, or educational challenges to significantly differentiate this group from their typically-developing counterparts, at least with regard to self-esteem. These outcomes, at least, support the well-established view that a sense of self is a complex and broad feature of human development (Berger, 1998).

The sensitivity of the IRAP was again highlighted in the current study when the data indicated the distinction between the samples regarding their implicit attitudes to others. The children with dyslexia showed a pro-other bias which was absent in the typically-developing children. Interestingly, this bias correlated with happiness and satisfaction. *Again*, these findings were unexpected, but not surprising. Future IRAPs may target a sample of children with a more challenging form of disability, such as Emotional Behavioral Disturbance (EBD), in order to find greater distinctions in self-esteem in a young population.

It was anticipated that the children with dyslexia would require further procedural modifications, but this was not necessary. The only difference between the progression of this group and the typically-developing group through the IRAP was their increased response latencies. Also, because a response latency measure is incorporated into the correction procedure, the children with dyslexia did not make more errors than the typically-developing children. Taken together, the potential utility of the IRAP for measuring implicit cognitions in children with specific learning difficulties can be highlighted.

The current body of research was the first to examine the utility of the IRAP with children, including children presenting with specific deficits. There have been a limited number of studies which aimed to measure the implicit cognitions of children using the IAT. However, numerous modifications were required to render the procedure child-friendly. This was not necessary in the current research as the IRAP did not require further modifications than required with an adult sample. The data also yielded interesting findings relating to the self and others in the four samples of children. However, since advocating potential differences between the groups was not the primary aim of this research, further research would be required to investigate any potential behavioral implications of such implicit differences. Overall, the current work suggests a potentially positive trajectory for the IRAP as a measure of implicit attitudes and cognitions with a range of populations including children and those with learning difficulties. ■

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